Bell Work
19.Oct.2015
On a new "BW Q2.1"

Please log onto a computer and make your way to the class:

webpage → Labs → "Intro to Energy and Light RXTE"

Objective: You will be able to identify various forms of light energy and the symbols for frequency, wavelength, speed of light, planks constant, and energy in a mathematical expression.

EQ:

Is radiation bad for you or just misunderstood, why?

Turn in 19.Oct.2014

1. Beannium Lab
2. Average Atomic Mass

RXTE

Do ***all*** of the reading before answering questions.

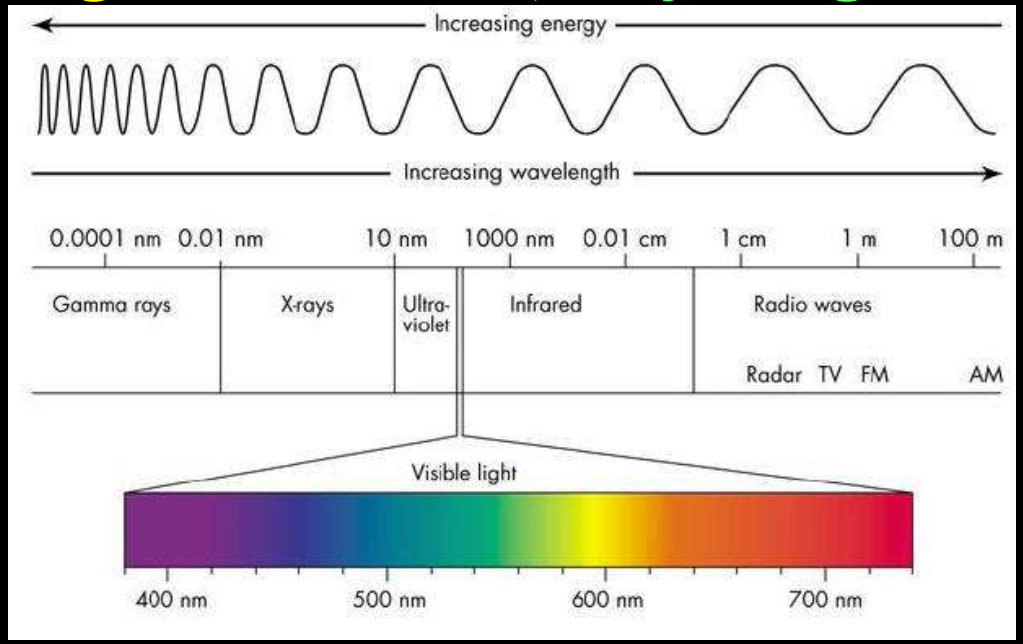
Complete on a separate sheet of paper appropriately titled; “RXTE”.

Home work
19.Oct

- Cereal/ cracker box
- Old CD or DVD (they will be broken into pieces)
- Continue with Science Fair

Bell Work
20/21-Oct-2015
On a new "BW Q2.1"

A: If we have trouble seeing light at 325nm, what is the wave length in meters (use your green sheets)?



B: What region is the light in?

Objective

You will construct and then understand how to use a CD box/ paper SPECTROscope and decode the line spectrum it reveals.

EQ:
Is radiation bad for you or just misunderstood, why?

Warm up, get a text book and open to page 96

1. Which electromagnetic wave type has the largest wavelength?
2. Which electromagnetic wave type has the smallest wavelength?
3. Which electromagnetic wave type has frequencies lower than the red of visible light?
4. Which electromagnetic wave type has frequencies higher than the violet of visible light?

Root Word

Spectra:

-a broad range of varied but related ideas or objects,

-an array of entities, as light waves or particles, ordered in accordance with the magnitudes of a common physical property, as wavelength or mass

Latin: appearance, form, equivalent to spec (ere) to look, regard

Ex: Spectrum

http://dictionary.reference.com

The Spectrophotometer

Spectrophotometer: An instrument used to measure the intensity of electromagnetic radiation at different wavelengths.

The Spectrograph

What is light (white) light composed of?

Well … white light is not actually white – it consists of many different colors.

Light is actually a *spectrum* – it is studied by a device called a *spectrometer*

How to separate light

There are different ways to split white light into its different colors.

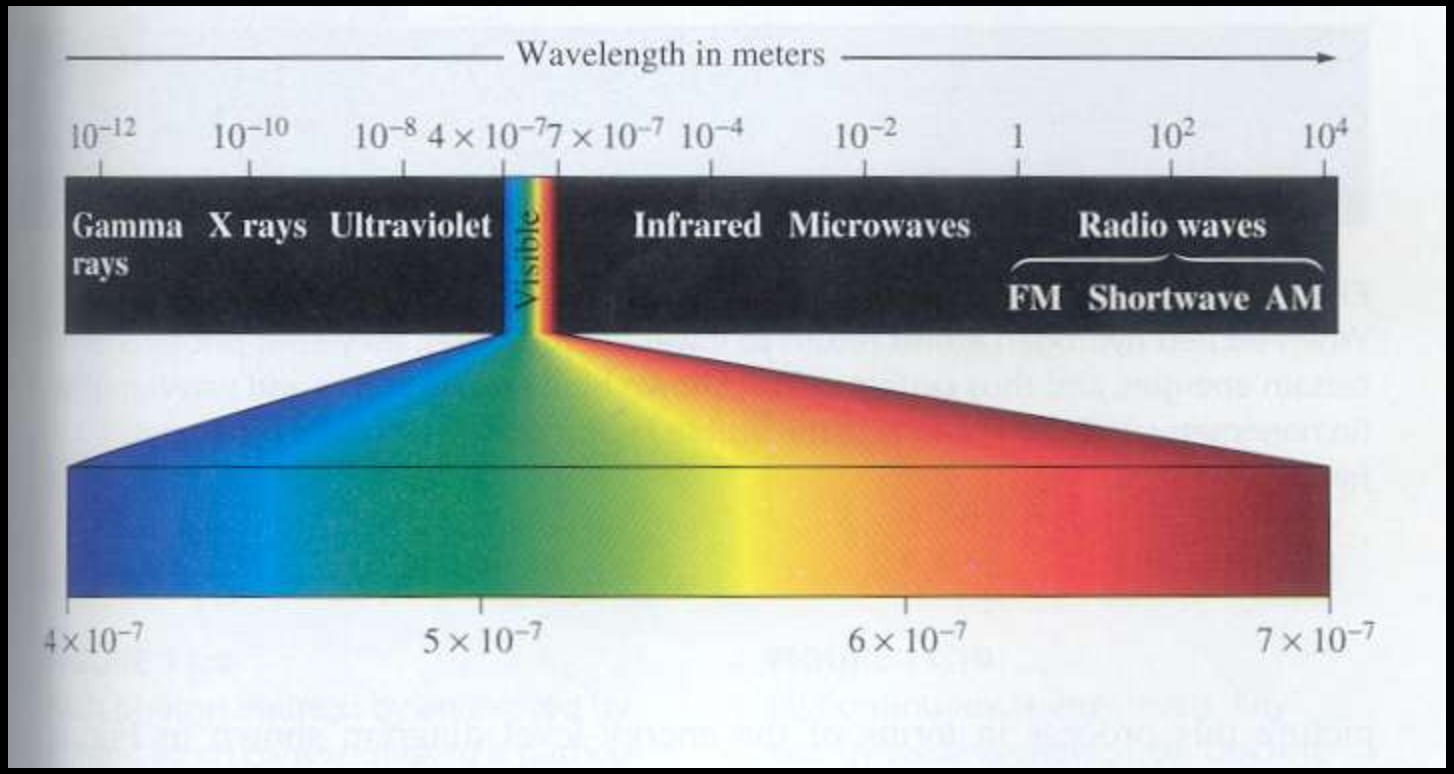
One way is to use a prism

We're going to use *diffraction grating*, which consists of a large number of tiny grooves, placed parallel to each other on a surface.

You actually have high-quality diffraction gratings at home:

Compact discs (CDs).

The Light Spectrum



CD Box Spectroscope

In the lab, safe handling of the scissors

Bell Work
22-Oct-2015

What is the relationship between wavelength and frequency or energy?

“ As wavelength increases frequency and energy _____”

List two (2) differences between emission and continuous line spectrum.

Objective:

Identify the various bands, (visible colors) present in various light sources in the lab.

Quick Quiz #4

A. In a perfect vacuum the speed of light is $3.0E^{8}$m/s. How far would a packet of yellow light travel in 2minute? Express in scientific notation.

B. What is the symbol for "frequency"

C. What region of the electromagnetic spectrum is yellow light?

Quick Quiz #4 5 points

A. In a perfect vacuum the speed of light is $3.0E^{8}$m/s. How far would a packet of yellow light travel in 2minute?

2min/1 x 60s/1min x $3.0E^{8}$m/s = $3.6E^{10}$m, 3points

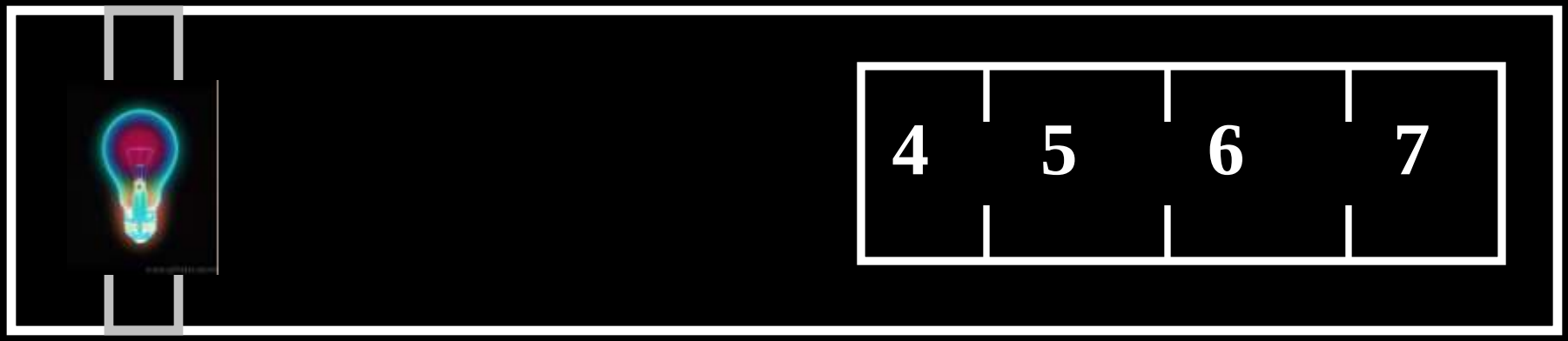
B. What is the symbol for "frequency"

ν, 1points

C. What region of the electromagnetic spectrum is yellow light?

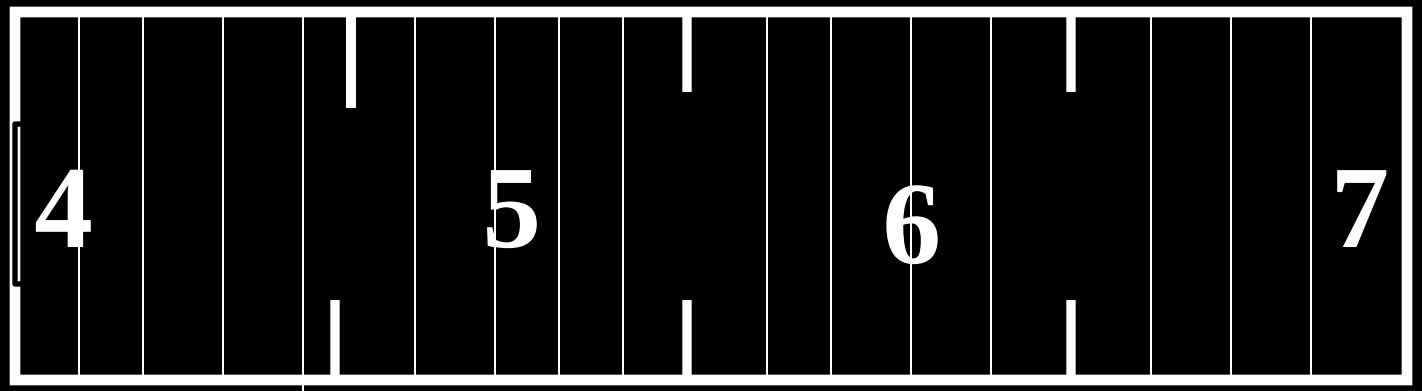
visible, 1points

How To use the Spectometer

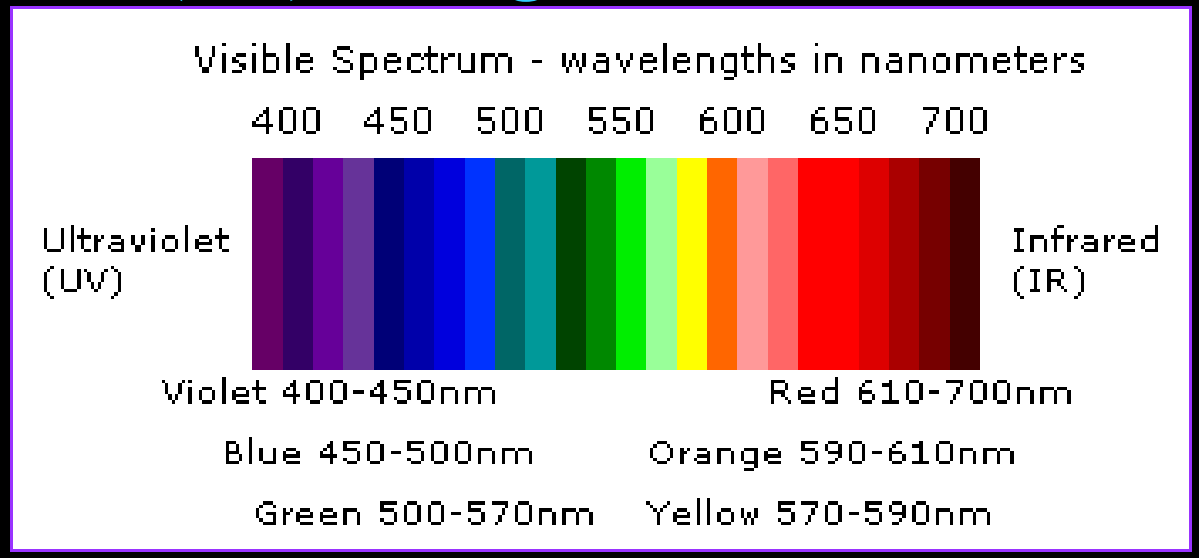


On the left side is a slit where you aim toward the light

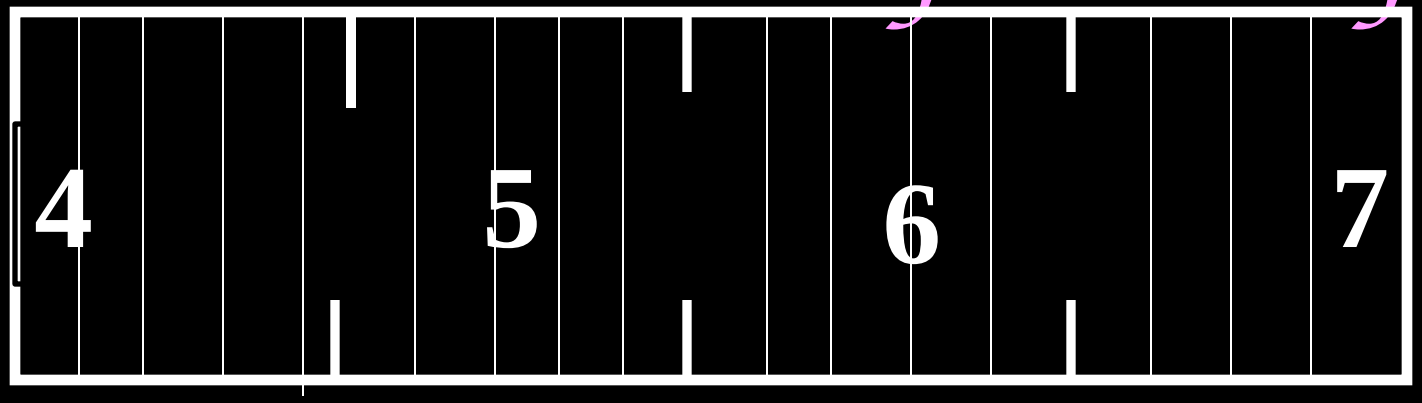
How To use the Spectoscope



On the right hand side is the grating measured in nanometer (nm). Going from 400-700nm.



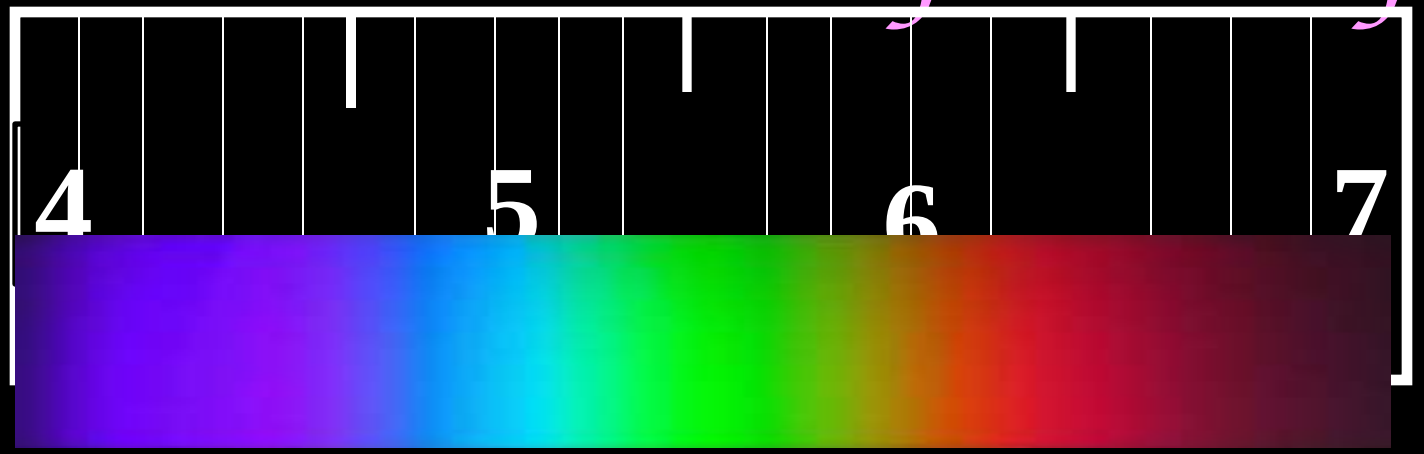
How To use the Spectoscope



The grating is where the colored line spectrum will show up.

Now aim the slit on the left at the light bulb….

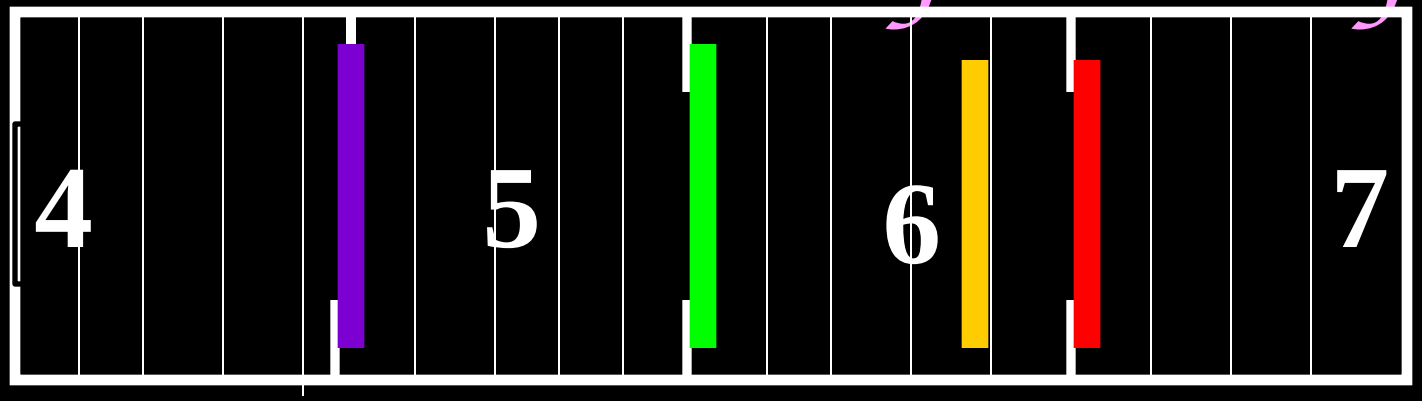
How To use the Spectoscope



What do you see?

What is the value of the “green” region?

How To use the Spectoscope



Now look at the florescent bulbs in the ceiling… draw what you see…

How To use the Spectoscope

The ***emission lines*** from the florescent bulb are produced by low-density mercury (Hg) vapor in the tube. The mercury also produces ultraviolet (UV) light, which is turned into a continuous spectrum of visible light by a thin layer of phosphor on the inside of the tube

Spectroscope Lab

CAUTION!!! Do Not Touch the power source OR tubes at any time.

Color what you see using the colored pencils.

How are they formed

Some of the spectra seen with the spectroscope have a continuous background.

Others consist of sharp lines on a continuous background, sharp lines without background, or even dark lines on a continuous background.

Why all this diversity?

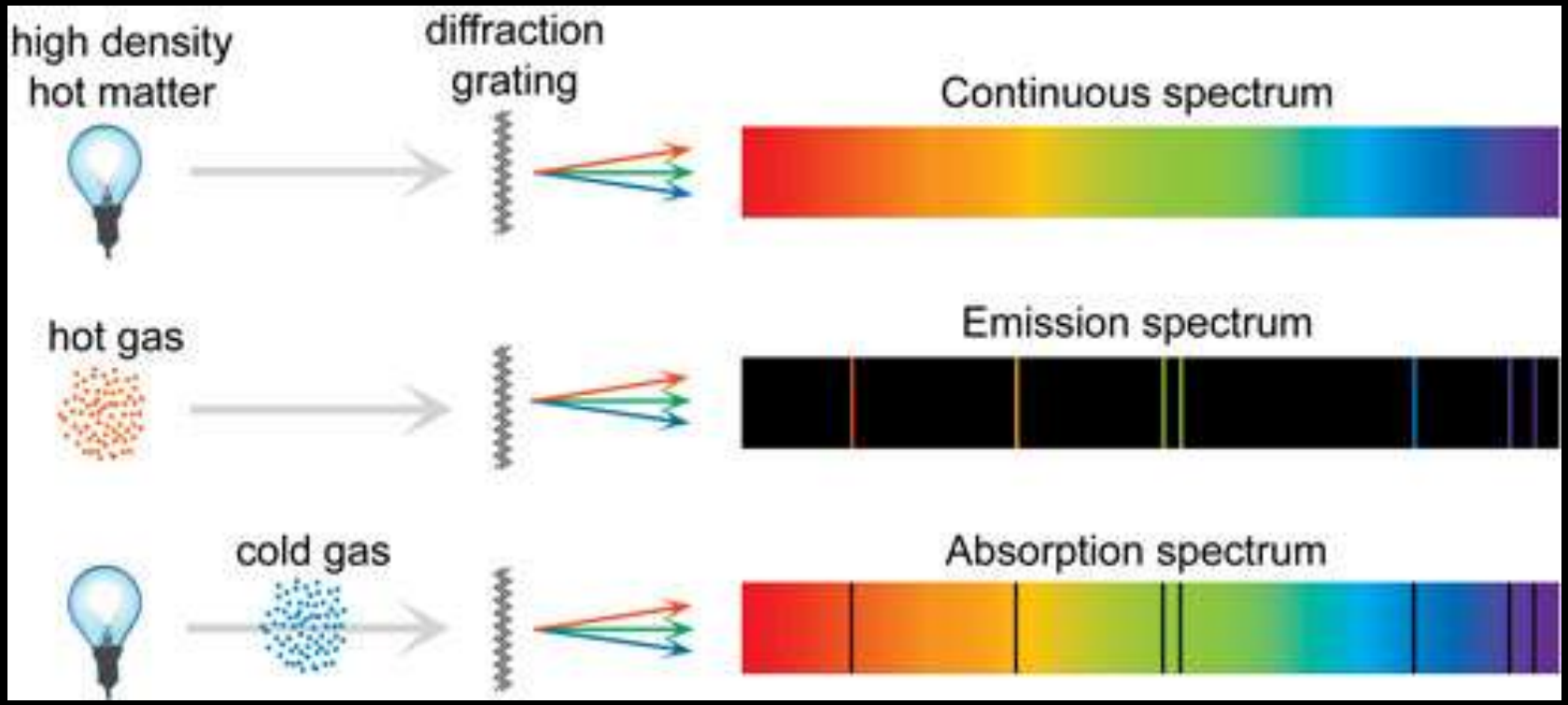
How are spectra formed?

Why is it happening

The atoms. An individual atom can find itself in an excited energy state, depending on whether its e^- occupy their usual orbits or have been excited to higher orbits and are emitting photons

The energy of the emitted photon determines its color.

Why is it happening



Bell Work,
23-Oct-2015

If $E = h\nu$, what is the energy (E) of a beam of light at 10^8/s, knowing that $h = 6.626E10^{-34}$ J·s?

Objective:

Identify the various bands, (visible colors) present when different metals are ignited in the Flame Test lab

Turn In, 23-Oct-15

Turn in CD Box Spectroscope Question (HW)

Flame Test lab

Read through literature on pre-lab, you are responsible for the content!

Pre-lab Questions:

1. Look at energy diagram in text book, Pg. 96.
2. Recall from yesterday
3. Will will skip the HCl cleaning ~~but will still clean with DI H_2O~~
4. Think about the colors?
5. Think about our lesson yesterday and spectroscope?
6. Look at all of the compounds.

When you finish make a data tabel for all of your collection please add a row for $CuSO_4$ and NiCl.

Flame Test lab

You will be rotating through each of the seven (7) stations:

a. Hold the Pt wire in the flame and record your results in the data table. Do not let it burn.

b. Repeat the flame test while attempting to view the flame with the spectroscope (2x so each partner may see) and record the colors of any bright lines you see.

c. Tidy the table then move on to the next lab station (3-5min max per-station).

Homework
23-Oct-2015

Memorize the seven (7) parts/ regions on the electro-magnetic spectrum (EMS) .
You should know these in order of increasing wavelength (λ) and frequency (ν).

Science Fair, duh Mr. Golden, every day.

Closure

What were three (3) difficulties you had in the lab?

How could/ did you over come them?

Bell Work,
26-Oct-2015

What are the various types of light (aka electromagnetic radiation), list spectrum in order of increasing frequency.

No Notes, all from memory!

Given that $c = \lambda\nu$, what is the frequency of a 700nm emission of light? Knowing that $c = 3.0E^{8} m \cdot s^{-}$?

Objective

You will finish the Flame Analysis lab

EQ: When speaking ill of an individual to others what does one risk?

Turn In, 26-Oct-15

RXTE (from computer work last Monday 19 Oct)

Period 1 New Seats

Period 2 New Seats

Bell Work
27-Oct-2015

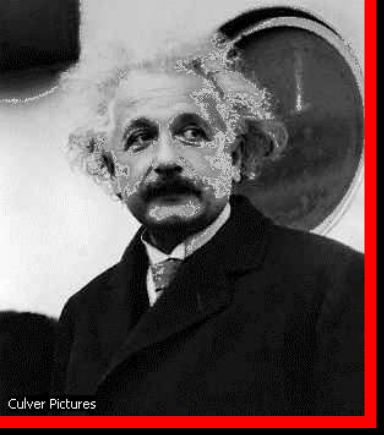
What is the formula for Energy we went over recently in bell work?

Formula for speed of light?

Objective

You will finish flame analysis post lab and partake in small class/ lab clean up.

EQ: When speaking ill of an individual to others what does one risk?



Albert Einstein

"According to the assumption to be contemplated here, when a light ray is spreading from a point, the energy is not distributed continuously over ever-increasing spaces, but consists of a finite number of energy quanta that are localized in points in space, move without dividing, and can be absorbed or generated only as a whole.“ –Albert Einstein 1905

The sections of the EM spectrum

https://youtu.be/hXe7EVv1y0Q

Lab Clean Up p.1

P.1: Inventory and clean lab bench items.

Make a legible list of what bench still needs.

If there are extra items in tray please remove.

Once finished with inventory, clean all glassware and leave out to dry.

Lab Clean up p. 2

P.2: Fill lab bench with correct supplies.

Insure bench has supplies needed based on list based off of 1st hrs list.

Replace all non clean able test tubes with new ones.

Once finished with inventory, clean all glassware and leave out to dry.

Lab Clean Up p.3

P.3: Return supplies and clean Lab bench tops.

Double check all supplies are in lab trays and return to appropriate shelf, if you need missing item please add.

Once finished, clean bench top.

LIGHT: What Is It?

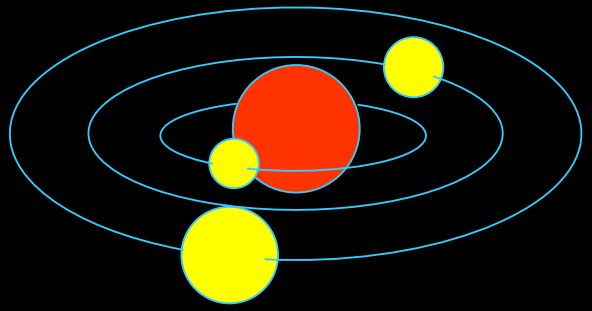
Light Energy

Atoms

- As atoms absorb energy, electrons jump out to a higher energy level.
- Electrons release light when falling down to the lower energy level.
- We will talk more abut this is a few weeks

Photons - bundles/packets of energy released when the electrons fall.

Light: Stream of Photons

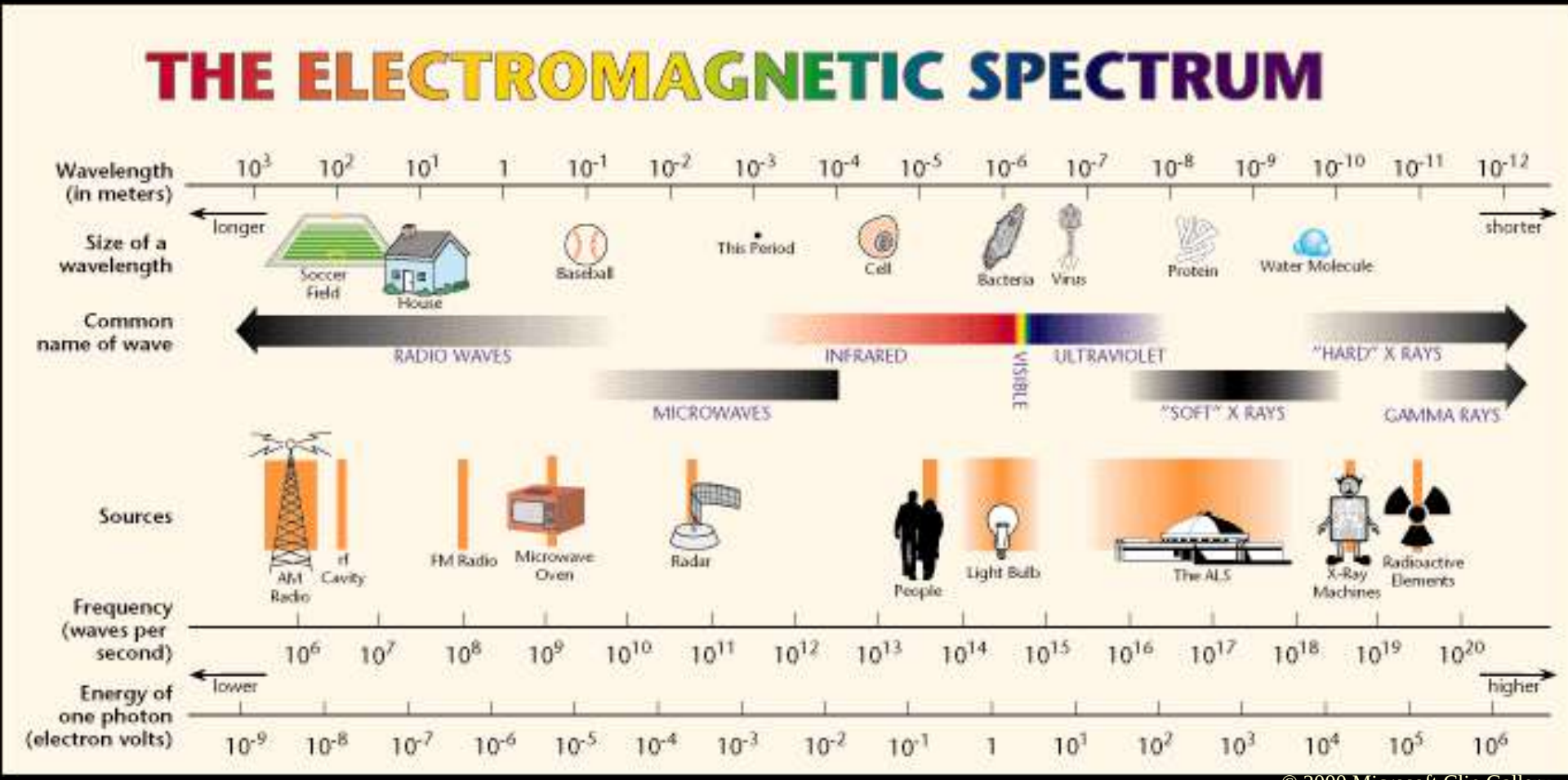


In your Notes:
metal Salt Visible light

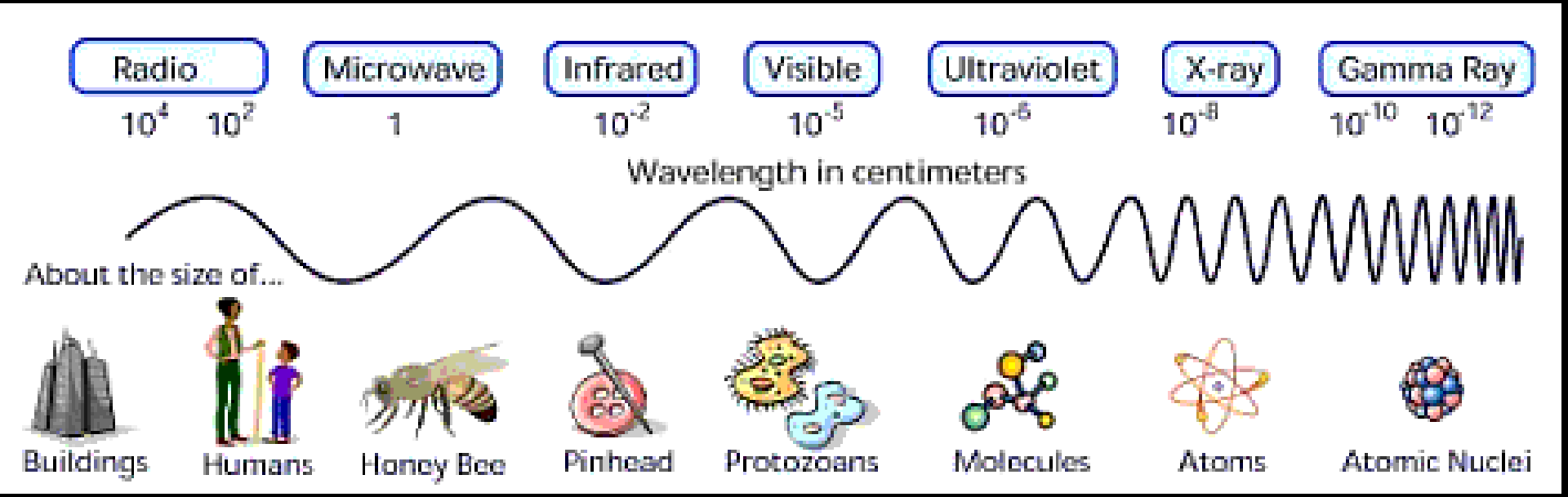
$SrCl_2$ $CaCl_2$ NaCl $CuSO_4$ $MnCl_2$ KCl

What do you see in each, be specific?

Electromagnetic Spectrum
Look at page 96 in your Text



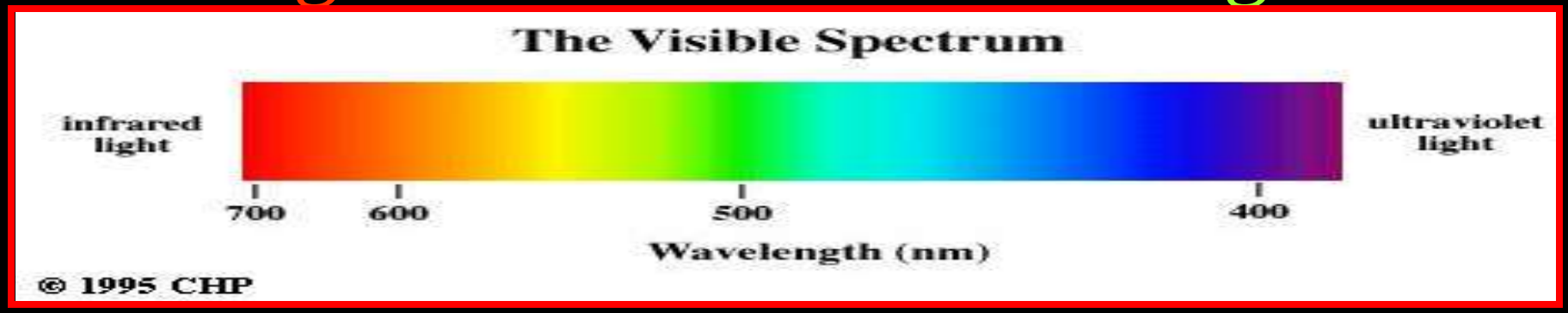
Electromagnetic Spectrum



Electromagnetic Spectrum

Visible Spectrum – Light we can see

- Roy G. Biv – Acronym for Red, Orange, Yellow, Green, Blue, Indigo, & Violet.
- Largest to Smallest Wavelength.



Electromagnetic Spectrum

Invisible Spectrum

- Radio Waves
  - Def. – Longest wavelength & lowest frequency.
  - Uses – Radio & T.V. broadcasting.

Modulating Radio Waves

Modulation - v**aria**tion of amplitude or frequency when waves are broadcast

- AM – amplitude modulation
  - Carries audio for T.V. Broadcasts
  - Longer wavelength so can bend around hills
- FM – frequency modulation
  - Carries video for T.V. Broadcasts

Short Wavelength Microwave

- Invisible Spectrum (Cont.)
  - Infrared Rays
    - Def – Light rays with longer wavelength than red light.
    - Uses: Cooking, Medicine, T.V. remote controls

Electromagnetic Spectrum

Invisible spectrum (cont.).

- Ultraviolet rays.
  - Def. – EM waves with frequencies slightly higher than visible light
  - Uses: food processing & hospitals to kill germs' cells
  - Helps your body use vitamin D.

Electromagnetic Spectrum

Invisible Spectrum (Cont.)

- X-Rays
  - Def. - EM waves that are shorter than UV rays.
  - Uses: Medicine – Bones absorb x-rays; soft tissue does not.
  - Lead absorbs X-rays.

Electromagnetic Spectrum

Invisible spectrum (cont.)

- Gamma rays
  - Def. Highest frequency EM waves; Shortest wavelength. They come from outer space.
  - Uses: cancer treatment

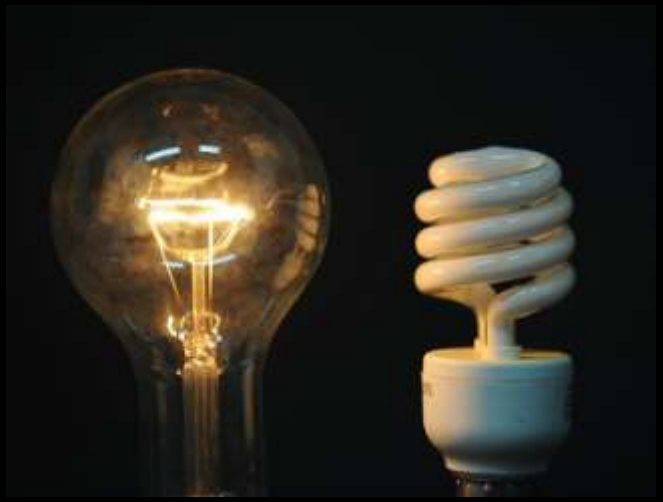
LIGHT & ITS USES

Fluorescent Light –

- Light produced by electron bombardment of gas molecules
- Phosphors absorb photons that are created when mercury gas gets zapped with electrons. The phosphors glow & produce light.

LIGHT & ITS USES

- Sources of Light
  - Incandescent light – light produced by heating an object until it glows.



LIGHT & ITS USES - Neon

Neon light – neon inside glass tubes makes red light. Other gases make other colors.

How You See

Retina –

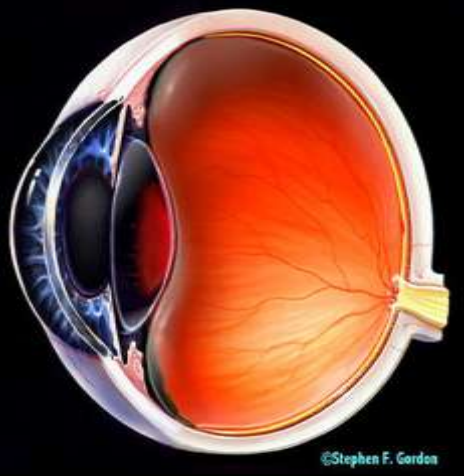
Lens refracts light to converge on the retina. Nerves transmit the image

Rods –

Nerve cells in the retina. Very s
to light & dark

Cones –

Nerve cells help to see light/color



Color of Light (Cont.)

Color of Objects

- White light is the presence of ALL the colors of the visible spectrum.
- Black objects absorb ALL the colors and no light is reflected back.

Flame Test lab

Continue to rotate through each of the eight (8) stations:

a. Hold the Pt wire in the flame and record your results in the data table. Do not let it burn.

b. Repeat the flame test while attempting to view the flame with the spectroscope (2x so each partner may see) and record the colors of any bright lines you see.

c. Tidy the table then move on to the next lab station (3-5min max per-station).

Bell Work
28-Oct-2015

Clear your desk of everything less a pencil, scratch piece of paper, calculator, periodic table (not needed but if you want…), and green sheet.

Have your calendar out.

On the top of scratch paper write name, Test 3, and a joke

Objective

You will be assessed on your recall and application of basic understanding of the make up of an atom, isotopes and EMS.

EQ: When speaking ill of an individual to others what does one risk?

Test 3 Pre-AP Chem. Isotopes & Electro Magnetic Spectrum

-All answers on answer sheet,

-Show all work,

-Go with your gut,

-If I am not able to determine how your work = your answer, it is wrong ☹

When finished get turn in test per instructions to front of room and get "**Frequency and Wavelength Worksheet**" **HW 28-Oct 1-10evens all work on numbered separate sheet of paper**

"

Extra Credit

Period 1 & 3

Re: Our guest lecture's demo

A. What was added to the reaction solution after the rxn?

B. It showed a color change in solution and another in the presences of the gas in the balloon, what was the color change a result of after the gas was added?

Bell Work
29-Oct-2015

How can you integrate the following formulas into one?

$E=h\nu$ $c=\lambda\nu$

How many meters is a wavelength of infrared light at $1.1x10^{3}nm$?

Objective:

By the end of the day you will be able to calculate the frequency, speed, and wavelength of light

EQ: When speaking ill of an individual to others what does one risk?

Turn In
29-Oct-2015

P.1 and 3 Turn In the “Flame Lab”

NATURE OF WAVES

- **Waves *(Def.)* – A wave is a disturbance that transfers energy.**
- **Medium – Substance or region through which a wave is transmitted.**
- **Speed of Waves – Depends on the properties of the medium.**
- **Vacuum - A space empty of matter**

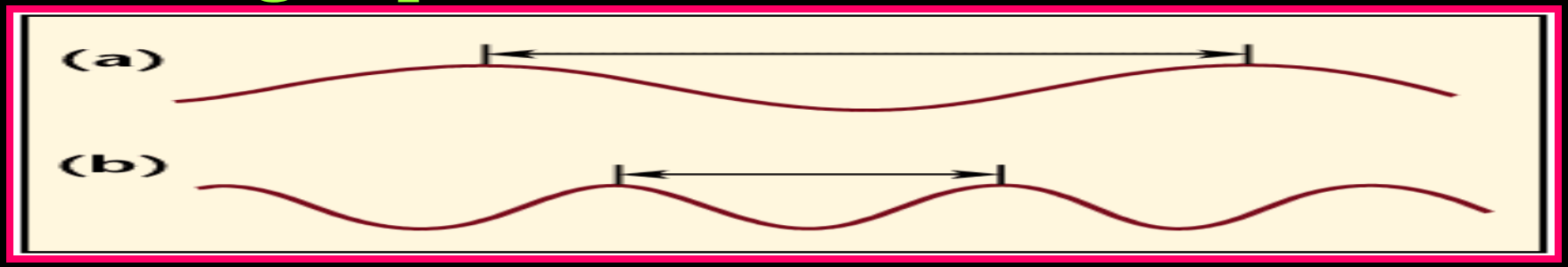
LIGHT: Particles or Waves?

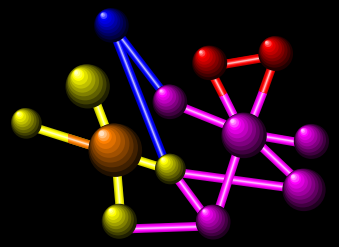
Wave Model of Light

- Explains most properties of light

Particle Theory of Light

- Photoelectric Effect – Photons of light produce free electrons





Electromagnetic Waves Speed of light

Speed in Vacuum

- 3.00×10^{8} m/s = Speed of light
- c = speed of light
- Speed only applicable in a vacuum. We will assume all conditions in this class to be a vacuum

Electromagnetic Frequency

Frequency

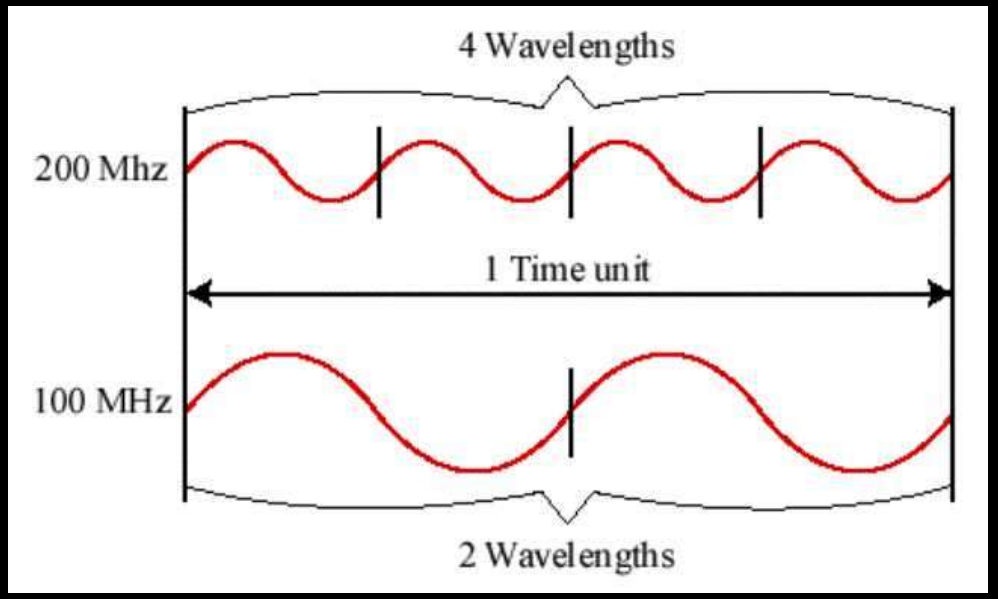
- Number of wave peaks in a given period of time

- **υ = frequency (Greek letter nu)**
- Units for frequency are Hertz (Hz) cycles per second (s^{-1})

Electromagnetic Wavelength

Wavelength

- Distance between peeks



- λ = wavelength (Greek letter lambda)
- Units for wavelength is meter (m)

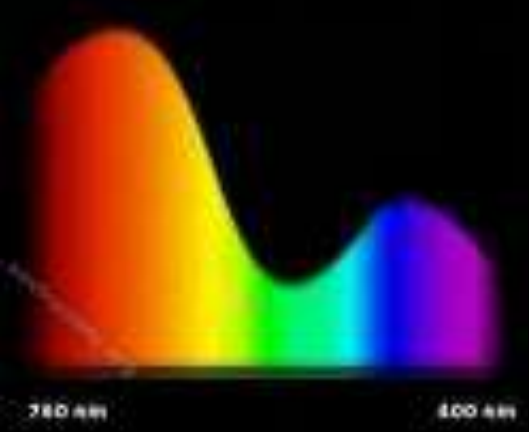
1m = 10^9 nanometer (nm)

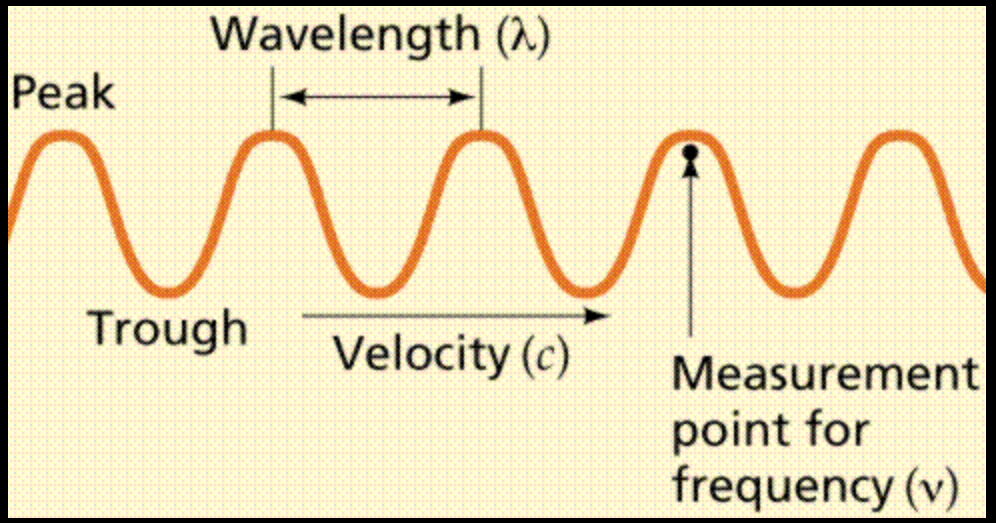
Formula For a Wave

The wave formula

$$c = \upsilon \cdot \lambda$$

Speed of light = frequency x wavelength





Practice Makes Perfect

What is the speed of a photon of light in nm/s if it has a wavelength of 480nm and a frequency of 7.50×10^{11} Hz?

Wavelength $\lambda = 480\text{nm}$

speed = $\lambda \upsilon$

Frequency $\upsilon = 7.50 \times 10^{11}$ Hz (1/s)

speed = $480\text{nm} \times 7.50 \times 10^{11}\ s^{-1}$

= _____

Your Turn

Calculate the frequency of red light that has a wavelength of 700.0 nm if the speed of light is 3.00×10^{8} m/s

HW 29-Oct-15

Finish !

“**Frequency and Wavelength Worksheet**”
all work on numbered separate sheet of paper

Bell Work
30-Oct-2015

What is the energy of light with a wavelength of 675nm?

What does diffraction grating do to incoming light in a spectroscope?

EQ: When speaking ill of an individual to others what does one risk?

Objective: you will understand how to find wavelength, and frequency.

Your Turn

A certain photon of light has a wavelength of 422 nm.

What is the frequency of the light?

Hint: recall what “c” equals

Max Planck's Quantum Theory

Planck's constant → ***h* = 6.63 x 10^{-34} J s**

J = Joule unit of energy equal to 2.34x10^{-2} Cal

$$E = h \cdot \nu$$

Energy = Planck constant x frequency(nu)

Practice

How much energy is there (in Joules) in a photon of light with a frequency of 5.00×10^{13} Hz?

$E = ?$

$h = 6.63 \times 10^{-34}$ J s

$\nu = 5.00 \times 10^{13}$ Hz

$$E = h\nu$$

$E = 6.63 \times 10^{-34}$ J s $\times$ 5.00×10^{13} s^{-1}

E = _____ J

Integration

Planck's Quantum Theory and Formula For a Wave.

Allows us to convert from wavelength (λ) to energy (J).

$$E = h\upsilon \quad \leftrightarrow \quad \upsilon = c/\lambda$$

$$\mathbf{E = h \frac{c}{\lambda}}$$

Lets Try…

Calculate the energy of a single photon of red light with a wavelength of 700.0 nm.

E =?

λ= 700.0nm

c = 3.00 x10^{8} m/s

h = 6.63 x 10^{-34} J /Hz

E = *h* c/λ

E = 6.63 x 10^{-34} J /Hz x $\frac{3.00 \times 10^{8} \text{ m/s}}{7.00 \times 10^{-7} \text{ m}}$

E = 2.84 x10^{-19} J

Practice

What is the wavelength of light in nm, that has a frequency of 6.6×10^{14} Hz

6.42×10^{-19} J of energy is required to remove an electron from a silver atom. What is the maximum wavelength of light that can do this?

Your Turn

Find the wavelength of a radio wave with a frequency of 650 kHz

Your Turn

Orchestras in the United States tune their instruments to an "A" that has a frequency of 440 cycles per second, or 440 Hz. If the speed of sound is 340.29m/s, what is the wavelength of this note?

Again

FM radio stations have frequencies from 88-108 MHz.

a) Find the longest wavelength FM radio signal.

b) Find the shortest wavelength FM radio signal

Before you Leave…

How can knowing the frequency of light help in determining its source (think about the electromagnetic spectrum)?

Again

What frequency of light has a wavelength of 4 500nm and a speed of 1.15×10^5m/s?

Max Planck's Hypothesis

According to the Planck hypothesis, all electromagnetic radiation is quantized and occurs in finite "bundles" of energy which we call photons.

quantized: A description of the individual values by which the energy of an electron can vary

Think about it before you leave

How can light be represented as energy using the equations we have looked at today?

Spectral Emissions of Various Gasses

Calculate the energy as frequency associated with every emission of light you see from the gasses

Gas	**Emissions** λ	**ν**	**E**
N_2			
O_2			
Black light			
Florescent Light			
Ar			